IV. Changes in Factors Affecting Unemployment Since 1973

Introduction

Over time, have the factors affecting unemployment in the doctoral science and engineering population changed? This section attempts to answer this question by comparing the results for 1993 with relevant information published from the 1973 SDR.[31]

Demographic Factors

Gender

The association between gender and unemployment in the doctoral science and engineering population was markedly different in 1973 than in 1993. Maxfield et al. found that "the unemployment rate for women was substantially higher than that for men (3.9 percent versus 0.9 percent in 1973)."[32] The researchers further demonstrated that the existence of a strong gender effect remained when controlling for either degree field or age differences. The unemployment rates for degree field ranged from 0.6 to 1.4 percent for men and 1.9 to 6.8 percent for women (Maxfield et al., p. 8). The unemployment rates, when controlling for age, ranged from 0.6 to 1.6 percent and 1.1 to 6.0 percent, respectively. In all age groups and degree fields, women had considerably higher unemployment rates than men. The smallest reported difference was in the field of mathematics, where the rate was 1.9 percent for women compared to 1.4 percent for men.

The lack of a statistically significant gender gap in 1993 is very different from NSF's early 1970s findings for a more broadly defined science and engineering population. In that study, 5.2 percent of female scientists were unemployed, compared to 2.3 percent of men and 15 percent of the few female engineers studied. Department of Labor researchers have noted a similar narrowing of the unemployment gap between men and women in the general population.[33]

Age

In 1973, the relationship between unemployment and age in the doctoral population was considerably weaker than in 1993 (chart 3). The 1973 rates, which ranged from 1.0 to 1.4 percent, were quite small and consistent with chance fluctuation. In contrast, 1993 rates ranged from 1.1 to 4.2 percent. Differences between 1973 and 1993 unemployment levels for ages 45 years and older were statistically significant, although the differences for the under-45 categories were not.

Factors Relevant to Career Decisions

In 1973 and 1993, the relationship between degree field and unemployment was discernible, though not particularly strong (table 9). The fields that had unusually high or low unemployment were different in both years, however. For example, physics and astronomy had an above average unemployment rate in 1993; in 1973 it was only slightly (and not statistically significantly) above average. Engineering and social sciences, with average unemployment rates in 1993, had significantly below average rates in 1973. The association between the unemployment rates in the two years was negligible (r = .24).

The observed changes between the 1973 and 1993 unemployment rates could be due to sampling error. For example, the observed 1993 unemployment rate for physicists and astronomers has a 95 percent confidence interval from 1.7 to 2.9 percent. Thus, it is possible that the unemployment rate for physicists and astronomers was only slightly above average for both

[31] It should be noted that in the *1973 Characteristics of Doctoral Recipients*, published by SRS/NSF, information on unemployment rates by race/ethnicity was included. However, at the point in time of the study, racial/ethnic minorities were not oversampled, and the available data are not useful for current purposes.

[32] *Op. cit.*, p. 5. Note that methodological differences between the 1973 SDR and the 1993 SDR result in population estimates that are not strictly comparable between the two surveys. For example, the 1973 survey included individuals with degrees from non-U.S. institutions, while the 1993 SDR did not. Although possible, it is unlikely that the survey changes completely explain the 1973 and 1993 differences.

[33] U.S. Department of Labor, p. 32.

Table 9. Unemployment rates for doctoral scientists and engineers, for selected degree fields: 1973 and 1993

Degree Field	1973	1993
	by Percent	
Life sciences	1.1	1.5 *
Mathematical and computer sciences	1.4	1.1
Chemistry	1.7	1.8
Physics and astronomy	1.5	2.3 *
Psychology	1.2	1.3
Other social sciences	0.9	1.6 *
Engineering	0.8	1.7 *
All Fields**	1.2	1.6 *

* Difference between 1973 and 1993 unemployment rates is statistically significant at .05 level, using approximate test.

** The total includes individuals in fields not displayed, because of small sample sizes.

NOTES: Information is presented only for degree field categories believedto be comparable during 1973 and 1993. Detail may not add to total because of rounding.

SOURCES: National Science Foundation/SRS, 1993 Survey of Doctorate Recipients. National Research Council, *Employment Status of Ph.D. Scientists and Engineers 1973 and 1975.*

years. These chance fluctuations contribute to the low correlation between the 1973 and 1993 rates. The true association may be more substantial than observed.

The low association of unemployment rates among degree fields in 1973 and 1993 is consistent, however, with the economic theory that, over time, markets tend toward equilibrium. For example, when changing demand leads to the scarcity of a skill, traditional economic theory predicts that the market will respond by increasing salaries for that skill, which, in turn, will induce more individuals to obtain the scarce skill, thereby increasing the supply of skilled individuals. There is no a priori reason to believe that this equilibrating force is inoperative in doctoral labor markets, even though the time it takes to complete a doctoral degree may make responses slower than for more easily obtained skills.

If individuals entering graduate school in 1973 had selected their degree fields on the basis of 1973 unemployment rates, they would not have significantly decreased their probability of being unemployed in 1993.

The strength of the association of unemployment with region of employment or residence was also similar in both years. In 1973 and 1993, the highest regional unemployment rate was slightly less than three times the lowest rate (table 10). However, unlike degree field, the ordering of the 1973 and 1993 rates appears to show some consistency (r = .45). In all three cases in which the unemployment rate was significantly above or below average in both years, the rates were in the same direction. In seven of the nine comparisons in which the unemployment rate was statistically above or below average in only one of the two years, the other unemployment rate was consistent in direction. Thus, if doctoral graduates had used the 1973 information on unemployment rates by region to assist them in choosing where to live, they may well have decreased their probability of becoming unemployed later.

Although the National Academy of Sciences studies did not report on the impact of sector on unemployment, the relative stability of employment in both academia and the Federal Government was documented in the 1972 NSF study.[34]

[34] NSF 1972, p. 68.

Table 10. Unemployment rates for doctoral scientists and engineers, by geographic location of employment[1]: 1973 and 1993

Region/State of Employment	1973	1993	Region/State of Employment	1973	1993
	by Percent			by Percent	
New England	1.2	1.4	South Atlantic	1.0	1.3
Connecticut	1.3	1.2	District of Columbia	1.0	0.7
Massachusetts	1.0	1.4	Florida	1.7	2.4
Other	1.5	1.5	Maryland	0.7	2.0 *
			North Carolina	1.1	1.6
Middle Atlantic	1.2	1.3	Virginia	1.1	0.9
New Jersey	1.3	1.3	Other	0.6	0.6
New York	1.4	1.2			
Pennsylvania	0.8	1.6 *	East South Central	0.6	1.1
East North Central	1.0	1.4	West South Central	0.9	1.8 *
Illinois	1.2	1.2	Texas	1.0	2.0 *
Indiana	0.9	1.0	Other	0.6	1.3
Michigan	1.2	1.3			
Ohio	0.9	2.2 *	Mountain	1.6	2.6 *
Wisconsin	0.9	0.5			
			Pacific	1.5	2.5 *
West North Central	1.1	0.9	California	1.6	2.8 *
Minnesota	1.0	1.8	Washington	1.6	1.9
Missouri	1.4	0.7	Other	1.1	1.1
Other	0.9	0.3			
			Other	--	1.1
			All individuals	1.2	1.6 *

* Difference between 1973 and 1993 unemployment rates is statistically significant at .05 level, using approximate test.

[1] Unemployed individuals are classified by the geographic location of their residence.

NOTE: Detail may not add to total because of rounding.

SOURCES: National Science Foundation/SRS, 1993 Survey of Doctorate Recipients. National Academy of Sciences, *Doctoral Scientists and Engineers in the United States, 1973 Profile*.

CONCLUSIONS

Important changes occurred in the relationships between demographic variables and unemployment rates between 1973 and 1993. The association between gender and unemployment rates declined substantially. In contrast, age had a stronger association with unemployment in 1993 than in 1973. Considerable change in the ordering of unemployment rates by degree fields was observed between the two years. However, the relationships between unemployment and place of employment/residence and unemployment and sector were similar.